Center Independent Research & Development: JPL IRAD

Development of a 10 Micron Laser Frequency Comb and Broadband Heterodyne Receiver (THERM)

Completed Technology Project (2015 - 2018)

Project Introduction

Development of broadband heterodyne receivers in the thermal infrared in order to enable very high angular imaging of exoplanets (such as the new Proxima Centauri planet), planet formation, and other objects of interest such as geosynchrnous satellites.

In the thermal infrared, the heterodyne SNR for interferometry is similar to that for direct detection inteferometry. Furthermore, heterodyne allows unprecedented baselines. The development of effective heterodyne receivers needs development of 10 micron laser frequency comb local oscillators and linear arrays of fast photodiode detectors. The THERM project is pursuing the development of an effective local oscillator and the required detector arrays as a collaboration between JPL and the Applied Physics Department at Caltech. It will also demonstrate the locking of independent LOs over large distances.

Anticipated Benefits

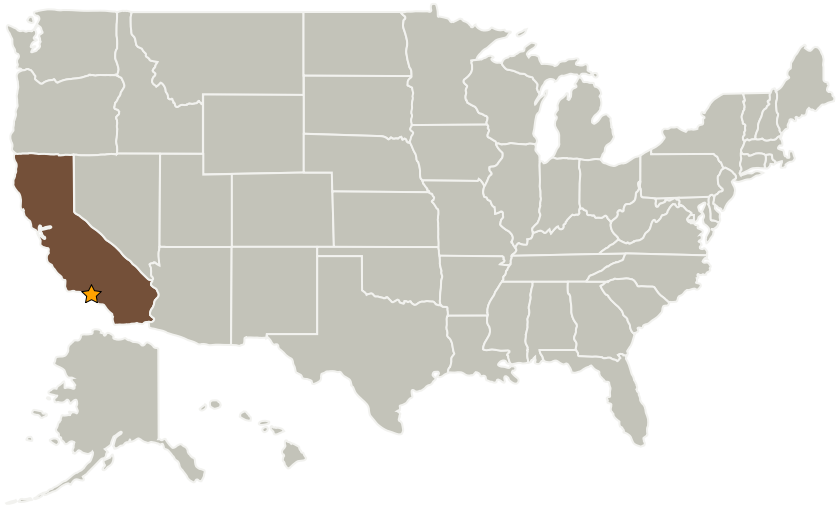
High angular resolution imaging of exoplanets is of broad interest to NASA astrophysics/SMD.

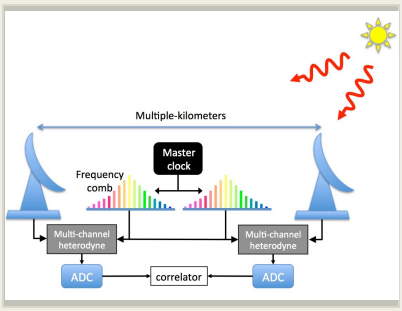
Exoplanet Imaging / Planet formation Imaging / Imaging the surfaces of the nearest exoplanets.

High resolution molecular spectroscopy would be of interest to industry.

DARPA can take advantage of this technology for geosat imaging from the ground.

Primary U.S. Work Locations and Key Partners





The schematic shows a conceptual application for THERM technology. It depicts two unconnected telescopes -- each with a commonly stabilized THERM receiver powered by a mid IR frequency comb local oscillator.

Table of Contents

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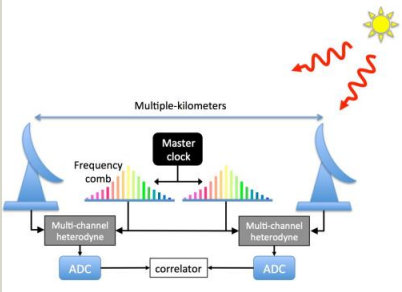
Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California

Co-Funding Partners	Type	Location
National Institute of Standards and Technology(NIST)	US Government	Boulder, Colorado

Primary U.S. Work Locations
California

Images



THERM Inferometer Concept
The schematic shows a conceptual application for THERM technology. It depicts two unconnected telescopes -- each with a commonly stabilized THERM receiver powered by a mid IR frequency comb local oscillator.
(https://techport.nasa.gov/image/24475)

Organizational Responsibility

Responsible Mission Directorate:
Mission Support Directorate (MSD)

Lead Center / Facility:
Jet Propulsion Laboratory (JPL)

Responsible Program:
Center Independent Research & Development: JPL IRAD

Project Management

Program Manager:
Fred Y Hadaegh

Project Manager:
Fred Y Hadaegh

Principal Investigator:
Gautam Vasisht

Co-Investigators:
Stephanie D Leifer
Kerry J Vahala

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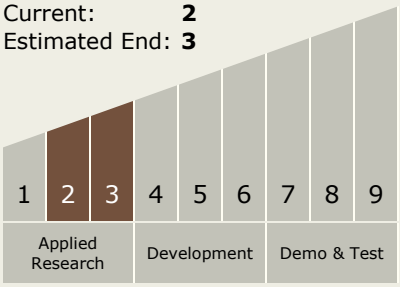
Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

Outside the Solar System, Foundational Knowledge

Supported Mission Type

Push